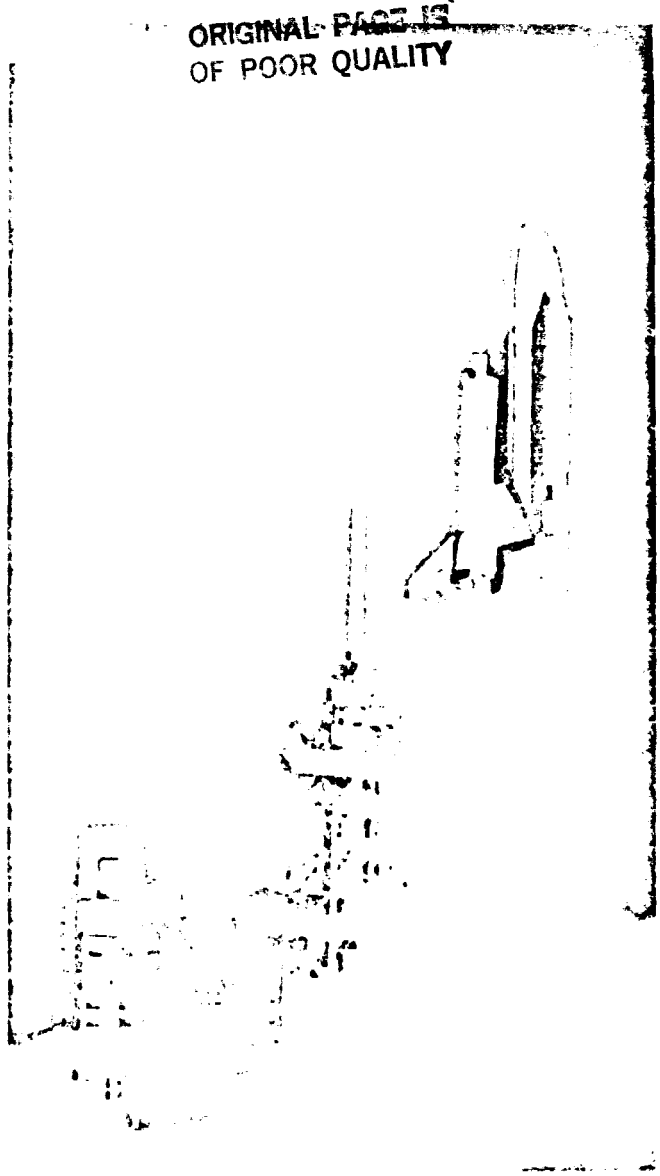
SQT

National Aeronautics and Space Administration

Mission Report

MR-001

"A Free People Capable of Great Deeds"—The Story of STS-1, The First Space Shuttle Mission



Launch of STS-1.

"Today our friends and adversaries are reminded that we are a free people capable of great deeds. We are a free people in search of progress for mankind."—President Reagan welcoming the crew of *Columbia*, April 14, 1981.

A new era in space promising countless benefits for people everywhere opened at 1:21 p.m. EST, April 14, 1981. At that time, the crew of the Space Shuttle orbiter *Columbia*—John W. Young, commander, and Robert L. Crippen, pilot—made a perfect landing on the hard-packed bed of Rogers Dry Lake in California's Mojave Desert, after a nearly flawless voyage in space.

This was the first airplane-like landing of a craft from orbit. Moreover, *Columbia* appeared hardly the worse for wear after its searing atmospheric entry when temperatures soared perhaps as high as 1650°C (3000°F).

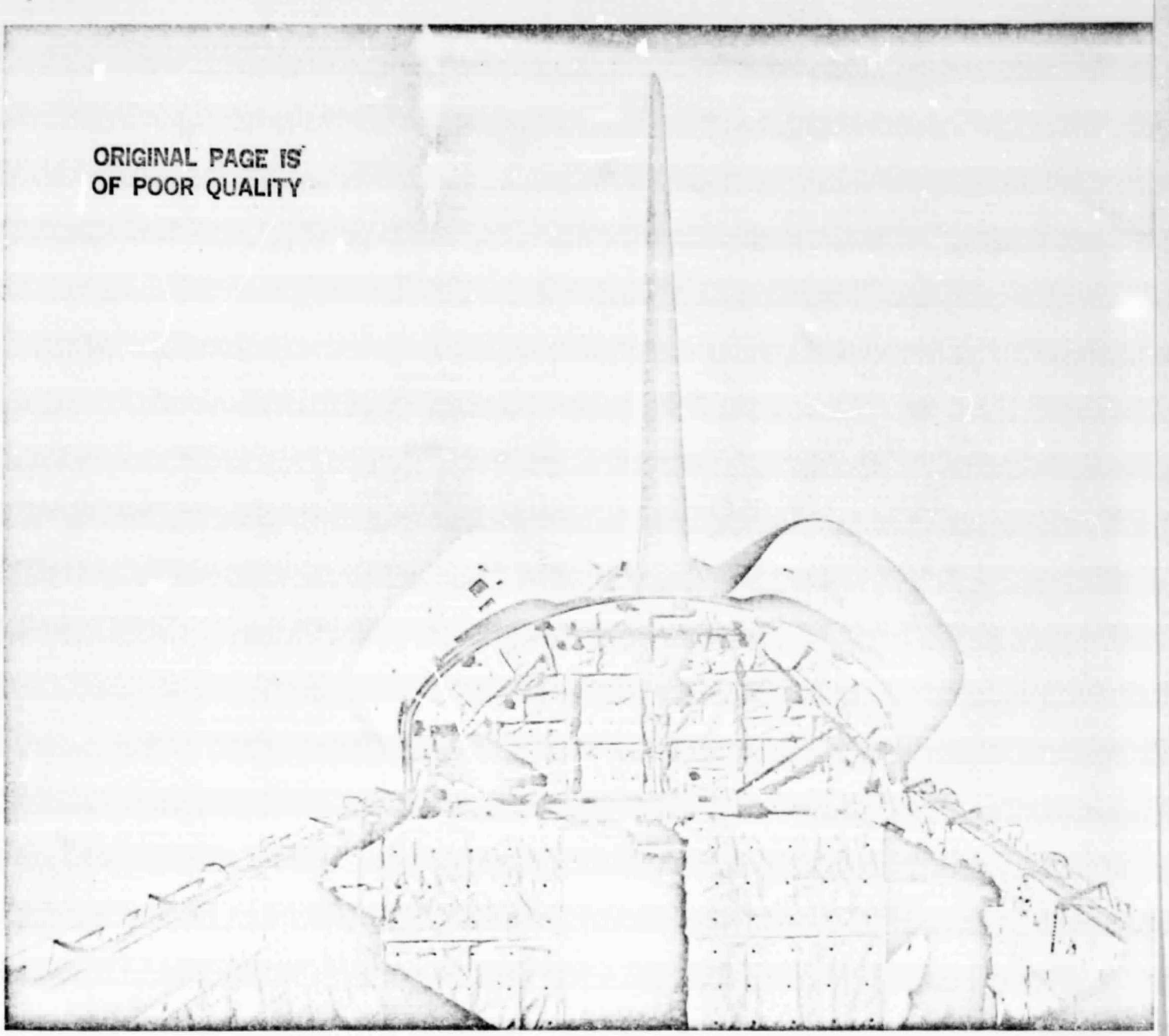
Its appearance was not deceptive. After a careful inspection of *Columbia*, NASA technicians reported that its condition after its historic flight was excellent and that *Columbia* should be capable of making at least a hundred round trips between Earth and Earth orbit.

Reusability is one of the goals of the Space Shuttle. The Shuttle includes three major units: the orbiter, of which *Columbia* is an example; two solid rocket boosters, which also are recovered and reused; and the orbiter's external fuel tank for which there are no plans for reuse at present.

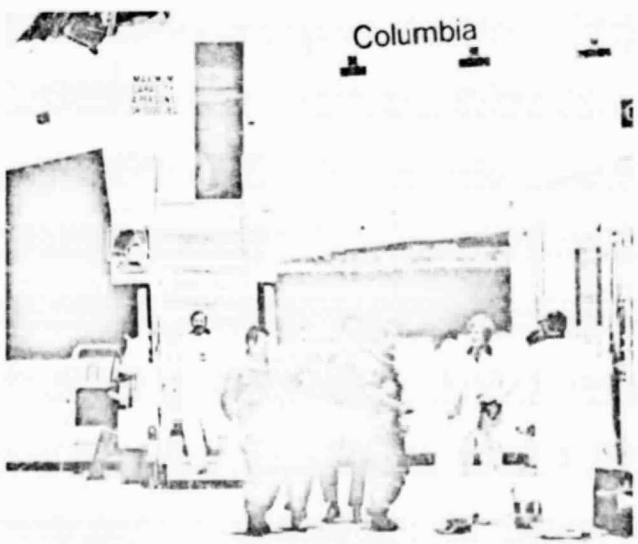
The solid rockets that helped launch Columbia were recovered in the Atlantic off Daytona Beach, Florida. They were determined to be suitable for refurbishment at a fraction of the cost of buying new rockets.

Reusability of the orbiter and the solid rocket boosters is one of the keys to significant cost reductions in space operations that the Shuttle is expected to make possible. The Shuttle is also designed to facilitate space operations and to open space to ordinary people of all nations who have important work to do there. The Shuttle is the kingpin of NASA's *Space Transportation System* (STS) which will include many more facilities to improve and lower the cost of space operations.

The solid rocket boosters used in STS-1 marked other



Photograph of open cargo bay of *Columbia*, clearly showing missing heat-shielding tiles.



Young (left) and Crippen (right) in space suits beside *Columbia* after landing.

Part of crowd (aerial view) awaiting landing of *Columbia*. Estimated totals were more than a million at launch in Florida and more than a quarter-million at landing. In addition, the flight was observed on TV by millions throughout the world.

firsts: the first time solid rockets have been used to launch a manned spacecraft and the first recovery of boosters for reuse.

The STS-1 mission was also the first time that any American spacecraft has been put into orbit without prior unmanned testing. As a result, the mission was conservatively planned in the interest of safety. STS-1 mission objectives were a safe ascent and safe return of *Columbia* and its crew.

Another first was the launch of an airplane-like craft into space with both wings and landing gear. STS-1 also marked the return of Americans to space after an absence of nearly six years.

Four Orbital Flight Tests Scheduled

STS-1 is the first of four planned orbital test flights leading to an operational capability late in 1982. The flights are designed to prove and improve the flight system as well as refurbishment capability, turnaround time, payload capability, and tracking and data acquisition.

Fleet of Orbiters Planned

Columbia will be used for the flight tests. When the STS is operational, *Columbia* will be joined by *Challenger*, which is in production, and later the planned *Discovery* and *Atlantis* and possibly a fifth orbiter, giving the United States the world's first fleet of manned aerospace vehicles.

Launch of STS-1

At 7 a.m. EST, April 12, 1981, Columbia's three main liquid-hydrogen-fueled rocket engines and two solid rocket boosters generated nearly 28.6 million newtons (6.5 million pounds) of thrust to lift the approximately 2-million-kilogram (4½-million-pound) Space Shuttle from Launch Pad 39A at Kennedy Space Center, Fla. Rising on a pillar of orange flame and white steam, the Shuttle cleared its 106-meter (348-foot) high launch tower in six seconds and reached Earth orbit in about 12 minutes. The solid rocket boosters and external fuel tank had been shed prior to orbit.

"Man, that was one fantastic ride," exclaimed Crippen, who was on his first space flight, as his heartbeat rose from 60 to 130 per minute. Young, a veteran of four space flights including an Apollo Moon landing, had a heartbeat rise of from only 60 to 85. Later, the 50-year-old Young said he was excited too and jocularly added: "But I just can't make it go any faster."

Orbital Operations

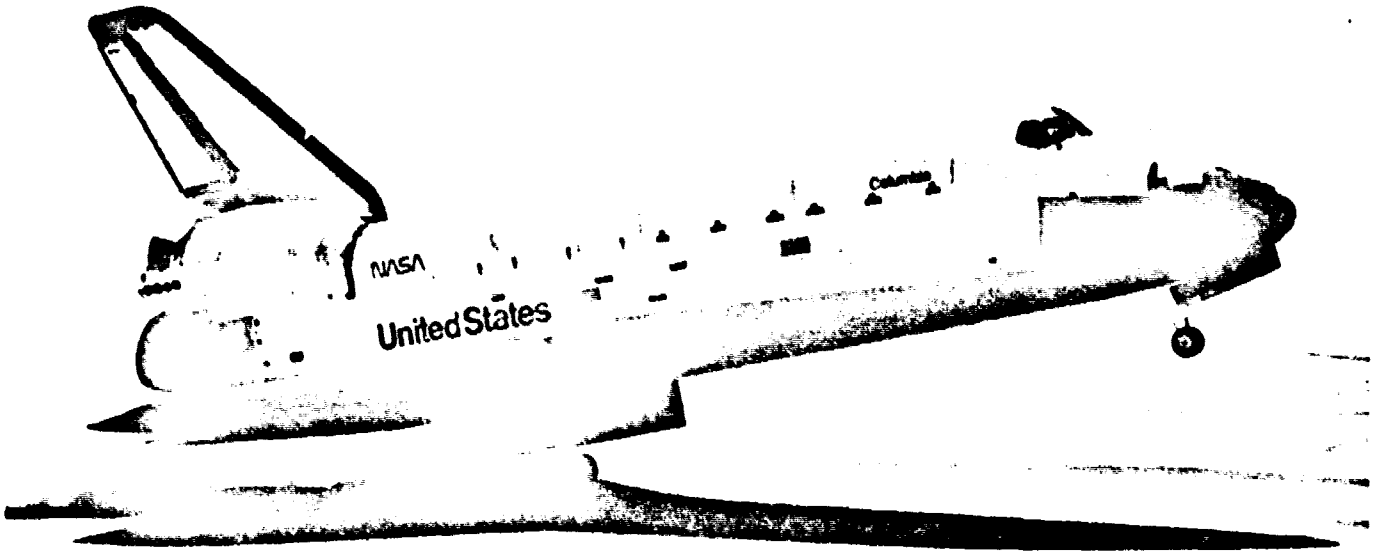
Young and Crippen changed their orbit from its original eliptical 106 by 245 kilometers (65 by 152 statute miles) to a circular orbit of 245 kilometers by firing their Orbital Maneuvering System at apogee (orbit high point). Later, they raised their orbit to nearly 277 kilometers (172 statute miles). They found *Columbia* easy to control.

They tried out all systems and conducted many engineering tests. They checked the computers, the jet thrusters used in orienting *Columbia*, and the opening and closing of the cavernous cargo bay doors. Aside from the obvious reason of being able to release satellites into and retrieve satellites from space, opening the cargo bay doors is critical to deploy the radiators that release the heat that builds up in the crew compartment. Closing them is necessary for return to Earth.

Young and Crippen also documented their flight in still and motion pictures. One view of the cargo bay which was telecast to Earth indicated that all or part of 16 heat-shielding tiles were lost, probably due to stresses of launch, from two pods on the tail section that house Columbia's OMS rockets. The loss was not considered critical as these pods are not subjected to intense heat. However, there are areas on the spacecraft's underbelly, nose, wings, and tail where the frictional heat generated by entry into the atmosphere could reach 1650°C (3000°F). As it turned out, the more than 30,000 tiles all adhered.

The tiles are made of a material that sheds heat so readily that it can be red hot on one side and cool enough to touch with the bare hand on the other. Moreover, unlike other heat-shielding materials used on previous spacecraft, they are not burned away by high temperatures.

Young and Crippen wore ordinary coveralls while in orbit. They kept *Columbia* in a tail-forward position and upside down relative to Earth. The upside-down position provided a better view of Earth and its horizon for orientation.



Deadstick (powerless) landing of *Columbia*.

Return to Earth

About 12:22 p.m. EST, April 14, Young and Crippen fired their OMS rockets for approximately 2 minutes and 27 seconds to reduce speed from their orbital velocity of around 28,000 kilometers (17,500 miles) per hour. At the time, they were over the Indian Ocean and began an hour-long descent to their landing field in California. They fired their attitude control (orientation) thrusters to turn *Columbia* right side up relative to Earth and nose forward. They fired thrusters again to pitch *Columbia's* nose up 40° so that the brunt of atmospheric entry pressures and temperatures would be taken by *Columbia's* broad well protected underside. About 12:48 p.m. EST, while over the western Pacific Ocean, *Columbia* began atmosphere entry.

After completing the fiery entry into the atmosphere, *Columbia's* computers transitioned from the steering rockets to the rudder and elevons (a combination of ailerons and elevators commonly used on delta-winged craft) to pilot *Columbia* through the atmosphere. They found the 89,000-kilogram (98-ton) *Columbia* relatively easy to control.

Columbia continued its descent like a powerless glider. Air drag caused it to steadily lose speed as its altitude dropped.

According to plan, Young and Crippen guided *Columbia* over their landing strip on the bed of Rogers Dry Lake in the Mojave Desert of California, banked sharply left, and looped back. They touched down at a speed of some 346 kilometers per hour (215 mph), which is about twice that at which commercial jetliners ordinarily land. The touchdown marked the successful conclusion of STS-1—2 days, 6 hours, 20 minutes and 52 seconds after lift-off from Florida.

As soon as Columbia stopped, it was surrounded by a convoy of vehicles carrying specialists who took measures to remove dangerous concentrations of explosive or poisonous gases in *Columbia's* cargo bay or in space surrounding its engines. They ventilated the entire craft, and withdrew residual fuel from engines. It took about an hour to assure that *Columbia's* vicinity was safe. The crew was then permitted to leave *Columbia* and to go to a waiting medical van. Young exited first. Before going to the van, he carefully inspected *Columbia's* exterior. His inspection completed, he smiled broadly and gave a thumbs-up sign.

STS-2 Crew Named

Shortly after the successful conclusion of ST-1, NASA named astronauts Joe H. Engle and Richard H. Truly as the crew of STS-2, the second Orbital Flight Test of the Space Shuttle. The mission is scheduled for September or October 1981.